AbstractID: 13546 Title: Quality assurance of 4D-CT for radiotherapy: Development of a cantilever phantom

Purpose: Modern 4D-CT machines require strict QA to ensure the accuracy of motion management protocols. A cantilever motion-phantom is presented capable of evaluating the accuracy of 4D-CT over a large range of amplitudes/frequencies. The phantom is light-weight, easy-to-use, portable, and is compatible with any motion signal acquisition software/hardware. **Method and Materials:** A motion phantom was designed to enable accurate QA of 4D-CT technology. Design criteria include: large range of motion amplitudes & frequencies, portable, light-weight, and tissue equivalence within the Field of View. The phantom is capable of producing large variable-amplitude, variable-frequency motions via a DC motor and eccentric rotating cam. The amplitude can be varied from 10 – 60 mm / frequency 1 – 40 cycles per minute. A Phillips brilliance big-bore CT scanner was used to compare static versus moving CT numbers for Water, Nylon, Cork, Perspex and Teflon (-1000 - +800 HU) with fixed amplitude of 55 mm and varied frequency from 2–8 s (2 s intervals). CT numbers per-phase for static and moving objects were recorded. **Results:** Results for the analysis of CT numbers across 10 phases of motion show a discrepancy at mid inhale / exhale points between static and moving objects of the same composition. This is in part due to the steeper motion gradients at these phases in contrast to the zero-gradient phases at peak-inhale / exhale. **Conclusion:** A phantom is presented which meets the criteria for modern 4D-CT QA. Portability makes this phantom an effective multi-center tool for QA of 4D-CT for radiotherapy. The phantom is light-weight, easy to use, has a large range of motion profiles, is able to carry a substantial load due to its cantilever construction and its large motion allows problems to be identified quickly with minimal time required at the scanner.